Creating Value Through Operational Excellence

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Executive Summary

Investors in private infrastructure assets have faced headwinds over the past several years—the result of both the COVID-19 pandemic and geopolitical upheavals. The macroeconomic environment has been volatile, with high inflation, rising energy prices, interest rates spikes, and supply chains in disorder. As investors focus on safeguarding their portfolios, fundraising and dealmaking have slowed amid questions about whether unlisted infrastructure investments are living up to their promise of low cyclical stability, stable and predictable returns, and protection against inflation.

The evidence that we present in this report shows that private infrastructure investment has passed the ultimate test and that the current temporary slowdown and adjustment of valuation expectations won’t dramatically affect the infrastructure class’s positive long-term trends. Infrastructure investments have delivered strong performance over the past five years, and the underlying secular megatrends driving demand for infrastructure remain in force and will offer even more investment opportunities in coming years. Meanwhile, ever-increasing government debt levels continue to drive the need for private capital in infrastructure, and institutional investors—despite contributing to the record $1.2 trillion in assets under management in 2023—say that they are still underallocated to infrastructure.

A closer look at how investors create value in this maturing and consolidating industry, however, reveals that they need to make some fundamental choices about their strategic positioning. Moreover, as multiples stabilize and the financing environment remains unstable, investors will need to rethink their approach to value creation. Indeed, 80% of the investors we surveyed think that operational value creation in infrastructure investments will become more important than ever. Responding effectively to these challenges will be crucial to successful infrastructure investing over the next three to five years.
Introduction

There is a pressing need worldwide for revitalized and new infrastructure. According to the World Economic Forum, the global infrastructure funding gap will exceed $15 trillion by 2040. Estimates of the investment needed to rebuild deteriorating infrastructure in the US alone run to $6 trillion. And that number pales in comparison to what’s needed to slow global warming—as much as $50 trillion over the next 25 years.

The world’s governments are already contributing to this effort. For example, the US’s 2021 Infrastructure Investment and Jobs Act authorizes $1.2 trillion in spending on roads, bridges, rail, water, the power grid, and high-speed internet. Yet the private sector’s role in providing a substantial portion of the funds needed is at least as important. We estimate that from 2018 to 2023, infrastructure assets under management grew by $700 billion, which represents a compound annual growth rate of 18% during the five-year period. And in a sample of 585 portfolio companies held by infrastructure investors, the asset class returned an impressive 6.8% annually across all investment strategies over that period.

Several factors led to a slowing of infrastructure fund-raising and deal-making in 2023. These included a volatile macroeconomic environment—with high inflation, high energy prices, and spikes in interest rates—geopolitical hotspots such as the wars in Ukraine and Gaza, and supply chains disruptions. The evidence shows, however, that the slowdown in fundraising is probably temporary. In light of the fundamental need for investment, the asset class’s essential attractiveness, and the need to deploy fresh capital while returning money to current investors, we expect market activity to return to normal soon, even if the current economic environment leads to changes in valuations, and thus asset prices.

The attractiveness of infrastructure investments and the maturity of the asset class are evident in the willingness of all types of investors, even retail investors, to participate. Industry mergers such as Blackrock’s landmark acquisition of Global Infrastructure Partners, CVC’s acquisition of the Dutch infrastructure fund DIF Capital Partners, and Bridgepoint’s acquisition of Energy Capital Partners demonstrate that infrastructure investments have become an essential part of multi-asset managers’ offerings. In fact, M&A is on the rise across the asset class. The average number of acquisitions by GPs of other GPs has increased from about 4 per year from 2015 to 2020 to 13 per year during the past three years.

Meanwhile, general partners (GPs) are exploring new infrastructure investment sectors and geographies and are creating derivatives of their flagship strategies in a maturing industry. For example, a new climate transition fund may offer a higher risk/return profile by investing in maturing technologies, such as electric vehicle (EV) charging, that are on the verge of scaling up and will evolve into established infrastructure in the future. As GPs seek greater diversification, limited partners (LPs) are thinking about how to grow from committing and co-investing with GPs into direct investing.

No matter which strategy investors pursue, success will ultimately depend on how their investments perform. To ensure strong performance, the ability to create value through operational improvements at portfolio companies is more important than ever. This is especially true as less commonly pursued value creation strategies—such as greenfield investing, roll-ups, and consolidation plays—have become more mainstream.

In this report, we examine the private infrastructure investment space comprehensively, considering its past performance, current status, and future prospects. Our goal in doing so is to provide a better understanding of how private equity (PE) companies and their LPs can help build the essential infrastructure that the world needs and create value in the process.
Over almost a full decade, private investment in infrastructure has generated a great deal of money. Although it still accounts for a relatively small percentage of total alternative assets under management (AUM) in the global alternative investments industry—$13.6 trillion in 2023—it boasted a compound annual growth rate (CAGR) of 18% from 2018 to 2023, outgrowing even private equity. (See Exhibit 1.) Stable returns, low cyclical, the ability to pass through cost inflation, a frequently regulated operational environment, and high barriers to entry have guaranteed unlisted infrastructure a spot in state-of-the-art strategic asset allocations.

In 2023, however, that rate of growth slowed considerably, as global fund-raising fell from a high of $176 billion in 2022 to just $89 billion. (See Exhibit 2.) Every geographical region saw declines, with fund-raising in the two largest, Europe and North America, dropping by 52% and 43%, respectively.

The decline in fundraising was notably sharp for core strategies at the less risky end of the risk-return spectrum—an understandable result, given that the strategy’s historical return expectations make it harder to compete against fixed-income strategies or infrastructure debt. (See the sidebar, “Four Investment Strategies.”)
Exhibit 1 - The Increase in Infrastructure Assets Under Management Has Outgrown Even That of Private Equity

Private capital AUM and dry powder, by asset class ($trillions)

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<thead>
<tr>
<th>Asset type</th>
<th>CAGR 2012–2023 (%)</th>
<th>CAGR 2018–2023 (%)</th>
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<td>Natural resources</td>
<td>8</td>
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<td>Infrastructure</td>
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<td>Private equity</td>
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Sources: Preqin; BCG analysis.

Note: Region percentages that round to less than 1% are not shown. Because of rounding, not all segment percentages add up to 100%.

Exhibit 2 - Infrastructure Fundraising Declined Significantly Across All Regions in 2023

Global fundraising from 2015 to 2023, by region ($billions)

Sources: Preqin; BCG analysis.

Note: Region percentages that round to less than 1% are not shown. Because of rounding, not all segment percentages add up to 100%.

1 Includes Latin America, Africa, the Middle East, and a diversified set of others.
Four Investment Strategies

Strategies for investing in private infrastructure fall into four categories, each defined by distinct types of investments and return expectations:

- **Core.** This is the most stable form of infrastructure investing because it focuses on assets that tend to be the least risky. The assets typically offer stable and often contractual income, feature full cost pass-through— sometimes linked to inflation—and in many cases are subject to regulation. Historically, investors have targeted an internal rate of return (IRR) of from 6% to 9%; but more recently, investors have used various techniques to boost those returns.

- **Core Plus.** Target assets in this category are similar to those for the core strategy. In core plus, however, although stable cash flows still matter most, investors often have the opportunity to deploy additional capex in growth platforms and can profit from any upside in capital appreciation. IRR expectations have historically landed in the vicinity of 9% to 12%.

- **Value Add.** This strategy focuses on assets with strong infrastructure characteristics such as stable cash flows, critical social importance, and high barriers to market entry. This includes assets that either have considerable growth and expansion potential through large-scale capex deployment or can be repositioned as core or core plus by de-risking them through decarbonization, for example, as well as some greenfield assets. Returns are generated from both income and capital appreciation, with investors targeting an IRR of 12% to 15%.

- **Opportunistic.** Assets in this category often include investments in emerging markets and maturing technologies. They have the highest degree of risk but also the greatest return potential. Returns are generated almost entirely from capital appreciation, with expected IRR of more than 15%.
This is confirmed by the growth in the opportunistic strategy, which promise higher returns at higher risk. Investors deploying core strategies are also looking for alternative ways to generate returns beyond the traditional 6% to 9%, which, if successful, would also boost their fund-raising efforts.

Despite the 2023 decline in fundraising, the outlook going forward is positive. As evidence of the forthcoming recovery in infrastructure fundraising, consider that LPs plan to increase their commitments to the asset class. Led by pension funds and private wealth managers, LPs expect to boost their investments by an average of 4% annually through 2026. (See Exhibit 3.)

Major multi-asset managers, including Blackrock and CVC, have demonstrated their confidence by recently acquiring large infrastructure platforms to make them part of their offerings. Retail investors, too, have discovered infrastructure investments, a trend to which many of the large GPs have already reacted by introducing dedicated retail products.

Ongoing interest in infrastructure as an asset class should be no surprise, given the strong historical track record of the most successful infrastructure funds. Of the 160 funds and their successor funds that we analyzed from 1993 to 2023, successor funds of those in the first quartile had a 70% probability of being in the first or second quartile at some later point during the period. (See Exhibit 4.)

### Exhibit 3 - Limited Partners Remain Committed to Allocating Funds to Infrastructure

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Sources: Prequin; Pitchbook; BCG analysis.

**Note:** Excluding direct allocations to alternatives and publicly traded alternatives within asset classes, such as real estate investment trusts. Sovereign wealth funds forecast data for 2030 is not available. LPs = limited partners.
Exhibit 4 - Successor Funds of the Most Successful Infrastructure Funds Continue to Deliver High Returns

<table>
<thead>
<tr>
<th>Reference fund (quartile)</th>
<th>Successor fund quartile distribution (%)</th>
<th>Probability of achieving first or second quartile (%)</th>
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<tbody>
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Sources: Preqin; BCG analysis.

Note: 160 funds were analyzed for the period from 1993 to 2023. Because of rounding, not all segment percentages add up to 100%.

In tandem with the slowdown in fundraising, the number of infrastructure deals completed in 2023 declined by 18%, while the average size of a sample of deals has fallen considerably after peaking in 2021. Two factors have contributed significantly to the slowdown in deal activity. On the buy side, with financing conditions deteriorating, deal teams have become more cautious about the prices they are willing to pay, especially for large-cap transactions. And on the sell side, players that bought many of their assets at high valuations in the past have been reluctant to sell, preferring to manage their portfolio companies through the current volatility. To maintain the flow of funds back to their LPs in the face of declining deals, some GPs are exploring divestment of minority stakes and rollover of stakes into continuation funds.

Furthermore, some infrastructure GPs have borrowed recent credit market innovations from the PE industry to artificially improve their returns. For this purpose, some funds use subscription lines—loans secured against the fund’s uncalled capital commitments that delay the timing of investor capital calls. Some also employ net asset value financing—loans secured against the fund’s invested capital and used to provide a partial or synthetic exit by returning capital to investors earlier than otherwise possible.

These actions should come as no surprise, given the adverse economic conditions that investors faced in 2023. The global surge in inflation, fueled by expansive monetary policies and rising energy prices, triggered a robust response by central banks that led to a significant uptick in interest rates.

Heightened concerns about a potential recession in developed Western countries further complicated the investment landscape. Geopolitical disruptions, including major conflicts in Ukraine and Gaza, introduced unprecedented levels of risk and reward for investors navigating the altered financial terrain.

Despite these uncertainties, several secular trends will increase the demand for new infrastructure in coming years, including urbanizing and aging populations around the world, ongoing changes in energy consumption, the global decarbonization agenda, and the growing demand for new digital infrastructure. Moreover, although the amount of dry powder funds awaiting investment did not grow significantly in 2023, it remains high, at $286 billion—and a considerable portion of that dry powder is concentrated in more aggressive core plus and opportunistic strategies. This suggests that substantial funds are available to investors to seize opportunities as they arise. In fact, given the increasing amount of dry powder and the reduced level of deal activity in 2023, the pressure on GPs to deploy capital will continue to rise as they seek to raise capital from LPs.

In short, given the great need, the large amount of money available, and the ongoing interest of GPs and LPs in the class, the outlook for private investment in infrastructure is strong. Further analysis of specific geographies and sectors can help reveal what the future of private infrastructure investing will look like.
Exhibit 5 - The Number of Infrastructure Deals Declined by 18% in 2023, as a Result of Several Macroeconomic Factors

Infrastructure global deal count and deal size, 2010–2023

Sources: Preqin; BCG analysis.
Note: Average deal size was calculated on the basis of a subset of 30% of global deals, per available data.

Exhibit 6 - The Amount of Dry Powder for Future Infrastructure Investments Remains High

Dry powder, 2015–2023 ($billions)

Sources: Preqin; BCG analysis.
Note: Excludes funds of funds, debt, and secondaries.
Although fundraising for private infrastructure fell across all geographies and sectors in 2023, the industry remains heavily concentrated by geography and by sector. Geographically, the great majority of private infrastructure investment activity in 2023 occurred in Europe and North America. Almost 75% of the world’s infrastructure portfolio companies were located there, and more than half of those were active in the energy and environment sector. (See Exhibit 7.)

Analysis of the world’s 56 largest international funds, covering investments in more than 1,500 assets from 2018 to 2023, indicates that North America saw the highest average deal size, at approximately $800 million, while Asia had the lowest, at approximately $300 million. The average deal size in Europe was in the middle, at $500 million. Aside from one very large deal in 2021, the average deal size in Australia was also considerably less than in North America. Sector analysis shows that deal value from 2018 to 2023 was most variable in two sectors (transport and logistics, and utilities) but relatively flat in three others (energy and environment, digital infrastructure, and social infrastructure). Two sectors—digital infrastructure and transport and logistics—consistently attracted the highest deal value, with an average of approximately $900 million per deal. (See Exhibit 8.)
**Exhibit 7 - Most Infrastructure Activity Is Concentrated in Europe and North America**

Number of portfolio companies by geography and sector, 2023

Source: BCG analysis.

Note: Includes the 56 largest investment portfolios.

**Exhibit 8 - The Average Deal Size Has Been Stable Across Regions, but Sectors Show More Variability**

Infrastructure deal value, 2018–2023, by region and by sector ($millions)

Sources: Preqin; BCG analysis.

Note: Deal value, deal average size, and deal count were calculated on the basis of available data (approximately 30% of global deals).

1 Africa, Middle East, and Latin America.
Analysis of the three sectors that we covered in depth—energy and environment, transport and logistic and digital infrastructure—provides guidance into where the best opportunities may lie:

- **Energy and Environment.** This sector covers a wide range of subsectors, such as conventional heat and power; district heating; energy services; renewable energy—including solar and wind; carbon capture, utilization, and storage; energy storage; waste and materials; energy storage; waste management; water supplies; and recycling. Several of these subsectors are playing especially prominent roles in driving the energy transition and will be responsible for much of the future growth in the sector, but overall demand for energy will also increase going forward.

- **Transport and Logistics.** This sector includes, among other subsectors, toll roads, ports, airports, container terminals, bus and rail operators, cold chain logistics, and electric vehicle charging. Among the most important factors here are urbanization, aging infrastructure, electrification, growth in demand for urban last-mile logistics, continued increases in e-commerce, and shifting manufacturing hubs.

- **Digital Infrastructure.** This sector comprises fixed and mobile networks, such as fiber rollouts, towers, data centers, subsea cables, and satellites. Relevant technological trends include IoT, digitization, big data, cloud computing, AI, and the need for broader mobile data and wireless coverage as internet usage rises.

Aside from the sectors that we cover in detail in this report, investments in social infrastructure and infrastructure 2.0 are also thriving:

- **Social Infrastructure.** This sector encompasses investments in health care, (including retirement homes and diagnostics), education (particularly K-12 education, in which a number of the larger funds have recently invested), civic infrastructure, and even recreation parks.

- **Infrastructure 2.0.** This sector consists of subsectors that have not historically been considered infrastructure but nevertheless exhibit the same characteristics, including long-term contracts, high retention rates, asset-backed business models, and critical services. Among the subsectors: certain media rights; players in the testing, inspection, and certification business; agriculture; and industrial contracting.

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**Energy and Environment**

Aggregate deal value of private investment in the energy and environment sector totaled $1.1 trillion from 2018 to 2023, making up almost 45% of all private infrastructure aggregate deal value during the period. Renewables and energy services account for most privately held assets in the sector, with Europe boasting the largest share of assets, followed closely by North America. (See Exhibit 9.) In fact, renewables represented a growing share of deals in the energy and environment sector over the past five years, and we expect them to continue to capture the largest proportion of such deals, in light of challenging international targets for the energy transition, such as those set by the EU Green Deal, and strong policy and funding support in legislation such as the US Inflation Reduction Act.

At the same time, investment interest is broadening from core renewables—primarily utility-scale solar and onshore wind—to riskier and potentially more profitable but sometimes far less mature opportunities such as hydrogen and innovative low-carbon solutions. (See Exhibit 10.) Solar and wind accounted for 80% of investment in renewables globally in 2018, but that figure has gradually declined in subsequent years, reaching 70% in 2023. The trend is particularly pronounced in Europe and North America, where "other renewables" have accounted for almost 40% on average in the past two years.

Going forward, developers of core renewables will benefit from the alleviation of supply chain issues, reduced equipment costs, and rising prices for power purchase agreements (PPAs). These tailwinds are partly counterbalanced, however, by the possibility of less favorable returns resulting from high asset acquisition costs, elevated interest rates, and increased operational and maintenance expenses. Moreover, volatility in power prices is impacting the length of PPAs, as new projects often feature shorter PPAs.

Identifying investible assets beyond core utility-scale renewables is becoming increasingly challenging. Certain segments and assets offer secure contracted off-take arrangements and well-developed value chain infrastructure. But uncertainty over such factors as government policies on the availability of hydrogen incentives increases the riskiness of these investments, especially in the US, where regulations can vary from state to state.
Investment interest is broadening from core renewables to riskier and potentially more profitable but often less mature technologies.
Exhibit 9 - Renewable Energy and Energy Services Make Up the Vast Majority of Assets in the Energy and Environment Sector

Energy and environment assets by geography and subsector, 2023 (number of portfolio companies; percentage of total)

Source: BCG analysis.

Note: Includes assets owned by the 56 largest investors. Because of rounding, not all segment percentages add up to 100%.

1 Africa, Middle East, and Latin America and Caribbean.
2 Including waste management and water utilities.
3 Including processing.
4 Including conventional power, industrial parks, utilities, and district heating.

Exhibit 10 - Renewables Are Driving the Energy Transition and Further Growth in the Sector, Especially in Europe and in Asia and Australasia

Number of deals and percentage of total

Source: BCG analysis.

Note: Includes only portfolio investments made by the 56 largest infrastructure investors. Because of rounding, not all segment percentages add up to 100%.

1 Hydrogen, biomass, low-carbon solutions, etc.
Other areas within the energy and environment sector offer significant upsides:

- **Transmission Projects.** Opportunities in this area involve alleviating bottlenecks in transmission networks or meeting the equity needs of investor-owned utilities. Long regulatory and permitting timelines pose risks to project schedules and returns, however.

- **Behind-the-Meter Solutions.** This area encompasses assets in the highly fragmented commercial and industrial solar and microgrid space, providing opportunities for M&A and exposure to contracted revenues.

- **Sustainable Fuels.** Growth in this area—which includes renewable diesel, hydrogen, sustainable aviation fuel, and methanol—reflects increasing demand, improved economics, and the versatility of the end product, which can utilize existing midstream and end customer infrastructure. The positive outlook for alternative transportation energy sources also benefits from rising diesel and jet fuel prices, voluntary corporate commitments to sustainability, and declining technology costs.

- **Battery Storage.** Opportunities in this area include investments in platforms that can smooth production and price volatility. Contracted agreements, often referred to as “tolling” agreements, are still in the early stages of development.

Overall, these less mature segments within the energy and environment sector have considerable potential but may carry business model risks and contract and revenue uncertainties. Several of them are benefiting from the focus of recently emerging climate transition funds on investing in maturing technologies that have not yet reached scale and therefore currently fall outside many LPs’ definition of “classic” infrastructure. The primary role of GPs in these funds will be to accelerate the technologies’ growth and penetration until they can fulfill the investment criteria of value add and even core investors. In every case, considerable expertise at the GP level is essential to select the right assets and manage them properly.

### Transport and Logistics

Private investment in the transport and logistics sector totaled almost $510 billion from 2018 to 2023, accounting for approximately 20% of all private infrastructure investment during the period. Railroad, air-related, and sea-related projects make up the majority of privately held assets in this sector. (See Exhibit 11.) The greatest share of those assets are in Europe. (See Exhibit 12.) Investment interest is particularly strong with regard to several transport and logistics subsectors:

- **Rail.** The next several years will see strong demand for new projects in the rail subsector, especially in the European market, in areas such as locomotive leasing and tank wagons. The drivers include continued long-term demand and the continent’s commitments to sustainability. Demand for rail assets has been remarkably resilient, rebounding vigorously from the impacts of the COVID-19 pandemic.

- **Air Transport.** This subsector has recovered strongly from its downturn during the pandemic. The fundamentals are solid, and large airline companies have already repaid the loans they received. Most of the activity in this subsector relates to investments in airports and adjacent services such as equipment pooling. Notably, many airports will come on the market in 2024. Meanwhile, high costs continue to constrain efforts to adopt alternative fuels for decarbonization in this subsector, although many investors look forward to a time when these technologies will be mature enough to invest in.

- **Sea Transport.** Like rail, this subsector is enjoying high demand as well as policy and regulatory support. For example, the UK government is committed to creating up to ten freeports around the country to serve as national hubs for global trade and investment. In the US, government authorities are pushing for sea investments, too. In 2022, the US Department of Transportation’s Maritime Administration announced nearly $450 million in grants for port-related projects—the largest investment program of its kind ever implemented in the US.
### Exhibit 11 - Investments in the Transport and Logistics Sector Vary Widely, Depending on Geography

Number of deals and percentage of total

<table>
<thead>
<tr>
<th></th>
<th>Europe</th>
<th></th>
<th>North America</th>
<th></th>
<th>Asia and Australasia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road</strong></td>
<td>18%</td>
<td>20%</td>
<td>38%</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td><strong>Rail</strong></td>
<td>36%</td>
<td>43%</td>
<td>60%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Air and sea</strong></td>
<td>36%</td>
<td>26%</td>
<td>14%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td><strong>EV charging</strong></td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Logistics</strong></td>
<td>12%</td>
<td>17%</td>
<td>20%</td>
<td>21%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Source: BCG analysis.

Note: Includes only portfolio investments made by the 56 largest infrastructure investors. Because of rounding, not all segment percentages add up to 100%.

1 Including aircraft and ship leasing, airport, and ports/terminals.

### Exhibit 12 - More Than Half of Privately Held Transport and Logistics Assets Are in Europe

Transport and logistics assets by geography and subsector, 2023 (number of portfolio companies; percentage of total)

<table>
<thead>
<tr>
<th></th>
<th>Europe</th>
<th>North America</th>
<th>Asia</th>
<th>Australasia</th>
<th>Other1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road</strong></td>
<td>192</td>
<td>61</td>
<td>24</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td><strong>Air and sea</strong></td>
<td>21%</td>
<td>25%</td>
<td>11%</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Rail</strong></td>
<td>51%</td>
<td>58%</td>
<td>17%</td>
<td>62%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>EV charging</strong></td>
<td>17%</td>
<td>0%</td>
<td>4%</td>
<td>8%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Logistics</strong></td>
<td>17%</td>
<td>6%</td>
<td>17%</td>
<td>21%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Source: BCG analysis.

Note: Includes assets owned by the 56 largest investors. Because of rounding, not all segment percentages add up to 100%.

1 Africa, Middle East, and Latin America and Caribbean.

1 Including aircraft and ship leasing, airport, and ports/terminals.
Investment deals in eco-friendly segments have risen in Europe, where 40% of all private investment went to charging for EVs in 2023.
• **Electric Vehicle (EV) Charging.** Europe, in particular, has seen a substantial rise in investment deals in eco-friendly segments. Fully 40% of all private investment in that region went to charging for EVs in 2023. Charging infrastructure is being deployed quickly, despite bottlenecks in the supply chain, grid constraints, and permitting issues, and commercial vehicle fleets are shifting to EVs. At the same time, players in the sector are consolidating, and more differentiated financing models are emerging. In short, the EV charging market remains very dynamic, and the endgame is not yet fully clear, so investors need to proceed carefully when deciding where to place their money.

• **Logistics.** This broad subsector can be subject to higher cyclical, yet it also boasts several attractive niches. For example, the growing need for effective cold chain logistics to manage shipments of fresh food continues to draw investor attention. The rapid acceleration of e-commerce during the COVID-19 pandemic generated high cash flows for investment, and shippers are expanding their footprints to shorten the distance to their customers. Global manufacturers in the US, Mexico, and Canada show increasing interest in reshoring their manufacturing activities—a shift driven by a combination of factors, including regulatory support, cost competitiveness, supply chain management, and geopolitical considerations. One secondary effect of these trends is rapidly increased interest in investments in warehouses, especially in the US, although movement in this particular area now seems to be slowing down.

Although high demand for many kinds of assets in the transport and logistics sector presents promising opportunities for investors, prospective investors must address the challenge of value creation in this sector. Acquiring assets related to airports, railway infrastructure, and train companies, especially in the current context of increasing competition, requires a well-thought-out strategy that extends beyond opening new facilities or routes.

---

**Digital Infrastructure**

Private investment in the digital infrastructure sector from 2018 to 2023 totaled almost $420 billion, accounting for almost 20% of all private infrastructure investment during the period. (See Exhibit 13.) This comes as no surprise. The world depends on reliable digital infrastructure as a backbone for how people connect, how some of the world’s most valuable companies do business, and how businesses enable innovations such as GenAI. As a result, demand for further investments in this vital asset class is strong.

In 2023, most of the activity in Europe in this sector focused on privately held data center assets, while the vast majority of assets in North America were in mobile data and end-user services. (See Exhibit 14.) Despite strong growth, this sector is undergoing considerable change, influenced by several macroeconomic and market-related factors.

For example, the current interest rate environment, coupled with high labor-cost inflation, has made fiber investments more challenging. Fiber was a key growth driver in the past, but investors today are more careful to assess how existing assets compare with planned buildouts, how much more capital may be required for further roll-out, and how much lead time will be needed before cash flows turn positive. As a result, the focus has shifted away from launching new fiber companies that focus on greenfield builds that lack an operational track record or customers and toward consolidation among top players and doubling down on operational excellence.
Exhibit 13 - Investments in Digital Infrastructure Have Grown Substantially over the Past Five Years

Number of deals and percentage of total

Europe

<table>
<thead>
<tr>
<th>Year</th>
<th>Fixed broadband</th>
<th>Mobile data and end-user services</th>
<th>Transmission towers</th>
<th>Data centers</th>
<th>Other data infrastructure and services</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>13%</td>
<td>19%</td>
<td>17%</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>20%</td>
<td>31%</td>
<td>20%</td>
<td>28%</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>54%</td>
<td>63%</td>
<td>25%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>15%</td>
<td>21%</td>
<td>4%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>4%</td>
<td>15%</td>
<td>4%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>17%</td>
<td>31%</td>
<td>20%</td>
<td>28%</td>
<td></td>
</tr>
</tbody>
</table>

North America

<table>
<thead>
<tr>
<th>Year</th>
<th>Fixed broadband</th>
<th>Mobile data and end-user services</th>
<th>Transmission towers</th>
<th>Data centers</th>
<th>Other data infrastructure and services</th>
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<tbody>
<tr>
<td>2018</td>
<td>6%</td>
<td>12%</td>
<td>13%</td>
<td>5%</td>
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<tr>
<td>2019</td>
<td>12%</td>
<td>17%</td>
<td>15%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>26%</td>
<td>33%</td>
<td>22%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>4%</td>
<td>17%</td>
<td>11%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>17%</td>
<td>31%</td>
<td>20%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>12%</td>
<td>21%</td>
<td>11%</td>
<td>3%</td>
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</tr>
</tbody>
</table>

Asia and Australasia

<table>
<thead>
<tr>
<th>Year</th>
<th>Fixed broadband</th>
<th>Mobile data and end-user services</th>
<th>Transmission towers</th>
<th>Data centers</th>
<th>Other data infrastructure and services</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>3%</td>
<td>6%</td>
<td>10%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>6%</td>
<td>17%</td>
<td>10%</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>8%</td>
<td>17%</td>
<td>33%</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>12%</td>
<td>25%</td>
<td>8%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>3%</td>
<td>33%</td>
<td>13%</td>
<td>6%</td>
<td></td>
</tr>
</tbody>
</table>

Source: BCG analysis.

Note: Includes only portfolio investments made by the 56 largest infrastructure investors. Because of rounding, not all segment percentages add up to 100%.

Exhibit 14 - Europe Has the Most Fixed Broadband Assets, While North America Is Focused on Mobile Data Services

Digital infrastructure assets by geography and subsector, 2023 (number of portfolio companies; percentage of total)

Europe

- Fixed broadband: 148, 58%
- Mobile data and end-user services: 90, 29%
- Transmission towers: 32, 18%
- Data centers: 17, 17%
- Other data infrastructure and services: 17, 17%

North America

- Fixed broadband: 148, 7%
- Mobile data and end-user services: 90, 86%
- Transmission towers: 32, 6%
- Data centers: 17, 6%
- Other data infrastructure and services: 17, 6%

Asia

- Fixed broadband: 6, 18%
- Mobile data and end-user services: 29, 35%
- Transmission towers: 34, 35%
- Data centers: 28, 28%
- Other data infrastructure and services: 18, 18%

Australasia

- Fixed broadband: 148, 41%
- Mobile data and end-user services: 29, 35%
- Transmission towers: 34, 35%
- Data centers: 28, 28%
- Other data infrastructure and services: 18, 18%

Other

- Fixed broadband: 6, 18%
- Mobile data and end-user services: 29, 35%
- Transmission towers: 34, 35%
- Data centers: 28, 28%
- Other data infrastructure and services: 18, 18%

Source: BCG analysis.

Note: Includes assets owned by the 56 largest investors. Because of rounding, not all segment percentages add up to 100%.

1 Includes data centers, satellites, other transmission assets, and other services.
Experts disagree about whether deals in Europe involving cell towers will slow down. Many European mobile network operators (MNOs) have already divested their tower infrastructure, and holdouts’ strategy will likely depend on their particular financing structure and need to deleverage. Moreover, many tower companies face a rising interest burden after having expanded rapidly country-by-country in the past. Given that cross-country synergies are difficult to realize, many tower companies are assessing their portfolio for divestment candidates to lessen their debt load. Hence, 2024 will likely see additional tower divestment deals. And because many companies in this subsector have grown through in-country consolidation, their primary focus now is on improving their operational performance to maximize cash conversion.

Although classic tower deals centered on passive infrastructure, investors are increasingly interested in pushing the boundaries of what constitutes an infrastructure investment in this subsector. Opportunities encompass both passive tower infrastructure and active infrastructure—placing, maintaining, and selling space on the antennas placed on towers. The resulting proposition thus evolves from managing passive assets to providing active services, such as radio access network as a service and mobile network as a service, to mobile network operators; it also expands on existing concepts of network sharing. These types of deals can unlock significant value for investors and for the MNOs themselves, which face high capex bills to satisfy customers’ increasing data needs and to drive technology upgrades such as 5G.

The data center subsector offers considerable opportunities in the coming years, too. Interest in all types of data centers is growing quickly because of high demand for computing power and data, and the potential for quick cash conversion. Hyperscaler data centers, in particular, offer reliable anchor tenants such as Google and Amazon, that can guarantee high utilization. This reduces counterparty risk, makes cash flows more predictable, and ensures higher investment scalability, since investors can buy a portfolio of data center assets. The rapid rise of artificial intelligence will further increase requirements for computing power and data, fueling the next wave of growth. A number of funds are trying to look beyond traditional digital infrastructure assets and are exploring various new strategies. For example, some are investing in assets that may involve manageable technology risks, such as satellites. Although this is not traditional infrastructure, it can still offer high visibility, stability, and contractual growth potential. In the telecom industry itself, a significant portion of investment is going into services and engineering firms that support infrastructure construction. Other companies are exploring alternative business models to deploy capital in infrastructure, such as joint ventures, to augment their ability to build larger infrastructure platforms.
Although more established alternative asset classes have already undergone multiple cycles of growth and consolidation, the recent cocktail of high inflation, sharply rising interest rates, supply chain disruptions, labor shortages in Western economies, and geopolitical turmoil has put the unlisted (that is, private) infrastructure investment asset class to the test.

The question is whether private infrastructure investment has managed to live up to its promise to generate stable, inflation-protected returns throughout the cycle, profiting from asset-based business models with high entry barriers, top-line stability consistent with the essential nature of the services it provides, and price-through mechanisms. Many investors have seen the volatile macroeconomic environment leave its traces in their asset portfolios, but the unlisted infrastructure asset class has mastered the litmus test and also outperformed listed infrastructure overall.
Relying on data from Scientific Infra and Private Assets, a provider of data on private infrastructure investing, we have analyzed five years’ worth of performance data for 585 infrastructure companies held in private portfolios across investment strategies, geographies, and sectors. Collectively, these investments produced average annual returns of 6.8% from 2018 to 2023. (See Exhibit 15.)

Deconstructing that overall return into its component parts reveals where investors have achieved the most value creation:

- Despite the economic headwinds of the past several years, the contribution from top-line growth and margin expansion was positive, as can be seen in the 1.8% CAGR growth in EBITDA contribution.

- The contribution from multiples, however, decreased considerably. Measured as the ratio of EBITDA to enterprise value, multiples contracted from 11.9 to 10.5, reflecting the macroeconomic outlook generally and increased interest rates in particular. (See Exhibit 16.)

- Debt-financed capex for capital-intensive business models such as renewables platforms, EV charging, fiber-to-the-home operators, and data centers had, on average, a slightly negative impact on the overall return contribution of the financial structure, but that effect was more than outweighed by the consolidated payouts to shareholders, which accounted for a significant portion of the overall returns.

Clearly, unlisted infrastructure investments have fared well compared to their listed equivalents, especially in light of the negative contribution to value creation of listed companies’ financial structures. Although multiples have dropped and interest rates are increasing, it is still possible to increase value by improving operations at portfolio companies—and thus improving top-line growth and expanding margins.

**Exhibit 15 - Private Infrastructure Investments Increased in Value by 6.8% Annually from 2018 to 2023**

Breakdown of annualized total shareholder return, 2018–2023 (%)

<table>
<thead>
<tr>
<th>Δ EBITDA</th>
<th>Δ Multiple</th>
<th>Δ Financial structure</th>
<th>Total value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>-1.6</td>
<td>6.5</td>
<td>6.8</td>
</tr>
</tbody>
</table>

**Sources:** Scientific Infra and Private Assets; BCG analysis.
Exhibit 16 - After Peaking in 2020, Multiples Have Decreased Considerably

EV/EBITDA, 2018–2023

Sources: Scientific Infra and Private Assets; BCG analysis.
Note: EV/EBITDA = Enterprise value/Earnings before interest, taxes, depreciation, and amortization.

Exhibit 17 - Value Creation for Investments in Listed Infrastructure Companies Was 2.5 Percentage Points Lower Than for Unlisted Investments

Breakdown of annualized total shareholder return, 2018–2023 (%)

Δ EBITDA Δ Multiple Δ Financial structure Total value

3.4 1.7 -0.8 4.3

Source: BCG analysis.
Note: Includes 470 global infrastructure assets in the S&P 500, MSCI, and iShares indexes.
As we detailed in the previous chapter, operational improvements at portfolio companies will be even more key to creating value for both GPs and LPs that invest in infrastructure. This focus is especially important in an economic environment in which costs are increasing and diminished deal activity has lessened the potential for returns from rising multiples and debt reduction.

In our experience, success in generating operational value depends on effectively addressing two key questions:

- How systematic and comprehensive is the approach to operational value?
- How effective are those efforts in the real world?

By applying these dimensions, we can split GPs into three archetypes (see Exhibit 18):

- **Traditionalists.** These investors typically do not have a comprehensive value creation framework that they systematically apply across the entire portfolio. Instead, they focus on selected portfolio companies, specific individual initiatives, and incremental improvements. Value creation is mostly the responsibility of the deal and management teams, sometimes supplemented with input from industry advisors. The results of their operational value creation efforts are not fully visible across the whole portfolio.
Exhibit 18 - Funds’ Efforts to Create Value Through Improved Operations Vary in Maturity Level

Operational value creation effectiveness

High

Masters

Traditionalists

Aspirants

Low

Selective

Systematic

Approach to operational value creation

Source: BCG analysis.

- **Aspirants.** These investors try to apply operational value creation methods systematically, but outcomes are nevertheless not fully visible in the financial results. Much like traditionalists, aspirants rely primarily on the deal and management teams, as well as industry advisors, to drive initiatives—and again the financials do not always fully reflect the envisioned outcomes.

- **Masters.** These investors take a systematic and institutionalized approach to operational value creation—one that aims to achieve truly transformational impact and yields measurable results. They establish systematic value creation plans, track them, and adapt them when necessary. They measure both management and deal teams against outcomes. Often they receive support from operational partners, in-house value creation teams, co-invested industry advisors, and external consultants in such endeavors as systematically developing the value creation plan, setting up a transformation office, and co-developing and driving selected initiatives.

In addition to applying their framework systematically across all portfolio companies, masters emphasize three practices that distinguish their approach to creating value through operational improvements (see Exhibit 19):

- **Rigid focus on value creation throughout the investment cycle**

- **Comprehensive view of all value creation levers**

- **Establishment of the prerequisites for delivering operational value**

**Focus on the Full Investment Cycle**

All too often, funds restrict their operational value creation efforts to extrapolating sell-side plans or devising plans that cover the first 100 days after closing a deal. Masters, on the other hand, begin planning at the due diligence stage, during which they develop and quantify a clear hypothesis on how to improve operational performance throughout the ownership cycle to serve as a foundation for their efforts.

During the first 100 days after closing, masters further develop the value creation plan with the company’s management, identifying early quick wins to target and identifying the key middle- and long-term value levers. As they begin executing the plan, starting with the identified quick wins, masters continuously track the results against the plan and adapt the plan as necessary.

Masters also put considerable effort into preparing portfolio companies for their exits, often developing revised value creation plans a year or two prior to the planned exit. The goal: to demonstrate to prospective buyers that value creation efforts have been successful, that relevant initiatives are already gaining traction, and that the potential to create even more value still exists. This tactic also enables masters to offer the buyer universe a comprehensive view of the value creation methods employed, and it gives them a head start in the sales process.
To build winning management teams, funds must actively assess them; and if capabilities are lacking, they must quickly hire top talent.
Assess All Value Creation Levers

Masters take into account every potential operational lever in the value creation framework in light of the portfolio company’s future positioning, including both top- and bottom-line levers—even if the value creation plan focuses on a selection of the most promising initiatives. (See Exhibit 20.) Choosing the levers to concentrate on requires detailed discussions of where to play and how to win, and masters devote special attention to determining how to position the asset for its future exit—a consideration that can significantly affect the company’s potential buyer universe and its earnings multiple, and thus its final exit price.

Levers that promote savings on direct and indirect costs can help de-risk a deal immediately and can free up funds to reinvest into the business for top-line growth. Masters also manage capex rigidly, especially at companies with large serial capex requirements such as renewables and fiber buildouts, EV charging programs, and major decarbonization efforts. Careful management of net working capital can help protect free cash flow and increase the company’s equity value.

Finally, masters spend time getting the enablers right—factors such as the operating model; IT and digitization (including deployment of GenAI); and environment, social, and governance issues that can have a profound effect on the company’s success and its final exit price.

Institute Performance Requirements

Through their command of a systematic value creation framework, masters ensure that an excellent management team and the right capabilities are in place. They also establish proven governance mechanisms, and they foster needed cultural changes—all in order to create the greatest value through operational improvements.

**Codified Framework.** Masters ensure that a clear and comprehensive framework for operational value creation is in place, and that the team is willing to improve it continuously. Creating and improving the framework will benefit from an organizational structure that encourages sharing experience across all deal and management teams at the fund, and from a strong and regularly updated knowledge management system that provides guidance on best practices.

**World-Class Management Teams and Strong Capabilities.** Masters ensure that they work with world-class management teams and that their funds develop and continuously improve the necessary capabilities at both the fund level and the portfolio level:

- **Fund-Level Capabilities.** Masters explicitly identify where responsibility for operational value creation lies, and they provide those responsible with the means to deliver value. Although different models have achieved success, masters usually give deal teams ultimate responsibility. For this reason, deal teams need support from various experts, including seasoned external board members, dedicated operational partners or inhouse consultants, and internal functional experts in procurement, IT and digitization, finance, ESG (environmental, social, and governance), and other issues.
Often, trusted external consultants can provide invaluable aid in facilitating the value creation plan between management and shareholders and in driving specific elements of the plan.

- **Portfolio-Level Capabilities.** Masters take care to have world-class management teams in place. Some of them conduct management appraisals early on and decide whether to complement existing teams with additional capabilities. They also determine very early in the ownership cycle which people at each portfolio company are best equipped to drive value creation on specific initiatives.

- **Rigid Governance.** Masters set up effective mechanisms to govern the value creation effort at both fund and portfolio levels. Fund-level governance efforts include establishing a dedicated, well-prepared portfolio review committee and mechanisms for tracking both operational results and financial outcomes. Operational value creation teams at the fund level often take an active oversight role across all of the portfolio companies and act as a sparring partner for the fund leadership, the deal team, and the management team.

Masters also put in place a transformation officer at the portfolio level to oversee value creation initiatives throughout the ownership life cycle. This role is critical, so it needs to be well incentivized and is often assigned to a senior-level person with experience either in consulting or in large-scale transformations. The transformation officer should report to the CEO or CFO and could be supported by project managers. The officer should also maintain time-tested tracking tools to monitor and manage each portfolio’s operational performance.

**Performance Culture.** Masters work hard to build a culture that prioritizes high performance in order to create value. To that end, they set clear expectations and goals for their deal and management teams, give them full ownership of and accountability for their efforts, and provide them with regular feedback on results. Clear and direct communication across the board is critical in keeping teams informed about what is working and what isn’t. Masters also create consistent incentive systems and mechanisms to recognize success, as well as clear development and promotion paths that reward results, not seniority. The goal is to ensure that management compensation plans fully align with investment results through equity ownership. This is a paradigm shift for some infrastructure investors that previously assumed that infrastructure management teams, unlike PE management teams, did not require incentivizing.

In short, to build winning management teams, funds must actively assess them; and if certain capabilities are lacking, they must move quickly to hire top talent in the market. Some funds have even experimented with opening their management participation programs to a broader group of employees at the companies they own, a process that can energize company employees and generate a sense of co-ownership.
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